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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Apparatus for Discharging Material

We, JOY MANUFACTURING COMPANY, a corporation organized and existing under the laws of the State of Pennsylvania, United States of America, located at Oliver Building, Pittsburgh State of Pennsylvania, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to mobile apparatus for intermittently discharging material.

In the field of mining it has been the general practice to employ continuously operating mining machines ("continuous miners") or boring machines which penetrate the face of a mineral vein, such as coal for example, whereby a substantially steady flow of material is discharged at the rear of the machine. When shuttle cars are utilized as haulage means, two such cars are normally employed to alternately receive disintegrated mineral from the miner, transport it to a main haulage system, discharge the load and return to the miner for another load. Assuming that working conditions are ideal and the haulage distance is relatively short, the mining operation must nevertheless be interrupted during switching of loaded and empty shuttle cars (changing out) with respect to the miner, thus making a so-called "continuous" operation a "cyclical" one. By way of example, assume that a miner has an average discharge rate of four tons per minute and the "change out" time is one minute. It is apparent that some provision for the storage of four tons of material is necessary in order to allow the miner to continue its attack on the mineral vein while the shuttle cars are "changing out," or alternatively, the miner must cease operation.

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Another system requires the material to be dumped on the mine bottom immediately behind the mining machine. This system has the disadvantage of requiring an extra machine and man, specifically a loading machine and an operator therefore in order to service the shuttle car. Furthermore, the mining machine cannot readily be backed out of the working area in an emergency.

According to the present invention we provide a mobile apparatus for intermittently discharging material, said apparatus comprising a hopper section having a discharge opening opposite a forward receiving end and a capacity of storing material continuously received, material displacing means for distributing the received material throughout the substantial confines of the hopper and between the receiving end and the discharge opening, a discharge section extending from the discharge opening and having a discharge end and conveyor means extending from the bottom of the hopper section to the discharge end and arranged for moving material adjacent the receiving end rearwardly and outwardly of the hopper, means being provided for the operation of the conveyor means to discharge material.

It is readily apparent that such an apparatus allows the mining machine to operate continuously, thereby resulting in increased production. Furthermore, since the apparatus of the present invention receives the material directly from the mining machine, a cleaner mine bottom is maintained. Also contamination with rock and debris from the mine bottom is precluded.

A further advantage residing in the apparatus of this invention is that its mobility allows the mining machine to back out of the working area quickly in the event of an emergency. Moreover, roof bolting drills could be mounted on the apparatus of

the present invention rather than the miner to preclude interference with production while the roof drilling is effected.

Still further advantages residing in the use of the apparatus of this invention are obtained by loading the shuttle car faster and more evenly than would normally occur when no such apparatus is employed.

Other objects and features of the invention will become more apparent upon consideration of the following detailed description illustrating the invention by way of example with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a material receiving, storing and discharging apparatus constructed in accordance with the principles of this invention;

Figure 2 is a side elevational view of the structure shown in Figure 1;

Figure 3 is a cross sectional view on the plane of the section line 3-3 of Figure 1;

Figure 4 is a reduced vertical longitudinal sectional view taken on the plane of the section line 4-4 of Figure 1;

Figure 5 is a view similar to Fig. 4 illustrating a second embodiment of the apparatus of this invention;

Figure 6 is a top plan view of a third embodiment of the apparatus of this invention;

Figure 7 is a top plan view of a fourth embodiment of the apparatus of this invention;

Figure 8 is a side elevational view of the structure shown in the embodiment of Figure 7;

Figure 9 is a perspective view of a modification of the distributing means of the structure shown in Figure 7;

Figure 10 is a perspective view of still another modification of the distributing means of the structure shown in Figure 7;

Figure 11 is a side elevational view of still another embodiment of the apparatus constructed in accordance with the principles of this invention; and

Figure 12 is a top plan view of still another embodiment of the apparatus constructed in accordance with the principles of this invention; and

Figure 13 is a cross sectional view of the structure shown in Figure 12 on the plane of the section line 13-13 of Figure 12.

Referring to the drawings and particularly to Figures 1 and 2, it will be observed that a material receiving, distributing, storing, and discharging apparatus constructed in accordance with the principles of this invention comprises a vehicle generally indicated as 10 having a body 12 supported by a suitable pair of propelling wheels 14 and a suitable pair of swivelly mounted steerable wheels 16. Propelling wheels 14 are driven by a motor 18 in a conventional manner well known in the art. The means for steering the wheels 16 may be of any conventional variety, and since many such arrangements are known in the art, no illustration is necessary.

The vehicle 10 is adapted to move along and behind a continuous miner and to receive the disintegrated material which the latter discharges and to discharge the material received thereby into a shuttle car, and has sufficient storage capacity so that the material discharged in a substantially uninterrupted manner from the miner may be stored within the apparatus during travel of the shuttle car relative to its discharge point in the mine or during switching (changing out) of loaded and empty shuttle cars with respect thereto. The miner has its own delivery conveyor, as is well known in the art, and this conveyor is adapted to discharge into the material receiving or forward end of vehicle 10. For purposes of this description, the forward end of the vehicle will be the left hand side of the vehicle as seen in Figs. 1 and 2.

The body 12 is provided with a wide material receiving and storing compartment or hopper generally designated 20 and a discharge section generally designated 22. Arranged substantially centrally of the vehicle at one side thereof between the wheels is a controller compartment 19. As this compartment is completely conventional and has been widely used in well-known commercial structures, it requires no further illustration. Preferably, the tramming and steering function is controlled by the mining machine operator while the discharge function of the vehicle 10 is controlled by the shuttle car operator.

Hopper 20 comprises a pair of side walls 24 and 26, a forward end wall 28 and a rear end wall 30. As shown in Fig. 3 walls 24 and 26 comprise major inclined portions 32 and 34, respectively, diverging upwardly outwardly from the bottom edges 36 and 38, respectively, and straight side portions 40 and 42, respectively, that terminate in upper edges 44 and 46, respectively. Forward wall 28 comprises an inclined portion 48 diverging upwardly outwardly from its bottom edge 50 and terminating in an upper edge 52. Sloping intermediate portions 54 and 56 connect side walls 24 and 26, respectively to the forward end wall 28. Rear end wall 30 comprises sloping end portions 57 and 58 adjacent the discharge section 22 which portions define a paassageway 59 for a purpose hereinafter more fully explained. Of course, any other suitable hopper configuration having adequate capacity is envisaged without departing from the present invention.

In order to accommodate the discharge or delivery conveyor of the miner, the material

receiving end of the vehicle 10 is reduced in vertical height as at 60 for a relatively short distance rearwardly of the forward end. This is particularly important when the vehicle is employed in an underground mine having relatively low headroom wherein vertical height is at a minimum.

Extending longitudinally along the bottom of the body 12 is an endless flight discharge or delivery conveyor 62 having flights 64 moved by flight moving chains 66 driven by sprockets 68 on a transversely extending shaft 70 driven through suitable worm and worm wheel mechanisms 72 and flexible connections 74 by suitable variable speed motors 76 through reduction mechanisms 78. Conveyor 62 extends longitudinally from the forward bottom edge 50 in the bottom of hopper 20 for a major portion of its length and then upwardly and rearwardly along the inclined bottom 80 of passageway 59 and is driven in a clockwise direction as shown in Fig. 2.

As shown in Fig. 3 upper and lower deck plates 82 and 84 are provided to support the active and return runs of conveyor 62 and a pair of elongated, hold-down, guide plates 86 and 88 are rigidly secured adjacent the bottom edges 36 and 38 of side walls 24 and 26, respectively, and above the horizontal longitudinal portions of the active run of conveyor 62 to guide and restrict the active run of delivery conveyor 62 along the bottom of hopper 20.

Means are provided for slowly distributing material in the hopper while precluding spill over the sides of the hopper. Such means comprise a pair of oppositely rotatable screw conveyors of opposite hand generally indicated as 90 and 92 extending longitudinally along the length of the hopper and having their longitudinal axes respectively lying in a horizontal plane parallel to the hopper bottom.

As the general construction of the screw conveyors are quite similar with the exception of being of opposite hand, the construction of conveyor 90 alone will be described in detail. Conveyor 90 comprises an elongated shaft 94 extending throughout the length of hopper 20 and having its ends suitably journaled in bearings (not shown) and suitably driven by motor 96 in any conventional manner, and since many such drive units are known in the art, no detailed illustration is believed necessary. Although shaft 94 extends along the length of hopper 20, it should be appreciated that other arrangements are contemplated whereby shaft 94 may extend only partially along the length of hopper 20. The longitudinal axis of shaft 94 lies in a horizontal plane disposed downwardly adjacent a horizontal plane that includes top edges 44, 46 of hopper 20 and in a vertical plane that is disposed inwardly adjacent the straight side portion 42 of side wall 26 and parallel thereto.

Slidably and telescopically received on shaft 94 are a plurality of spaced tubular members 98 of varying lengths having spiral screw conveyor flights or scrolls 100 suitably rigidly secured thereon respectively as for example by welding. A plurality of threaded apertures 102 are spaced along the longitudinal length of shaft 94 so that the tubular members 98 can be secured in a variety of positions along the length of the shaft 94 as shown in Fig. 1 as by screws 104 for example for the purpose of increasing or decreasing the gaps between scrolls to suit the conditions found. Other suitable adjusting means may be employed, if desired, such as a key and slot arrangement by way of example. Determining factors for spacing the scrolls would be the composition of the particular material being handled, the size of such material and its angle of repose. The last scroll, however, is preferably spaced a predetermined distance from rearward wall 30 and a small pile of material will normally remain in the rear of hopper 20 after the discharge thereof.

In order to insure that the material stored in the material receiving or forward end of the hopper will be substantially evacuated first, a pair of baffle or restrictor plates 106 and 108, hereinafter referred to as "fish plates," are rigidly secured to the top surface of guide plates 86 and 88, respectively, as by means of screws 110 for example. A plurality of threaded apertures 112 are spaced along the longitudinal lengths of guide plates 86 and 88 so that the fish plates can be secured in a variety of suitable positions along the length of hopper 20. It is to be appreciated that the principles of this invention contemplate the use of any other suitable means for adjusting the fish plates longitudinally relative to hopper 20.

It will be noted that the edges of the fish plates facing each other define a passageway 114 and have inclined edges 116 that diverge forwardly and terminate in forward edges 118. By providing such inclined edges, rock or other hard foreign debris will be guided and cammed rearwardly through passageway 114 during rearward movement of the stored material and thereby prevent such debris from becoming lodged between the lower surfaces of the fish plates and the flights of delivery conveyor 62.

Upon operation of delivery conveyor 62, material trapped between the flights 64 forward of the fish plates will travel with such flights underneath the fish plates which restrain the heaped material above and rearwardly therefrom, thus enabling the trapped material to move rearwardly towards the discharge section. The moving flights along

with material conveyed thereby travelling beyond the fish plates provides a shearing action whereby the material rearwardly of the fish plates will remain at substantially the same level until nearly all the material forwardly of the fish plates is displaced. Because disintegrated material from the mining machine will be continuously discharged into the receiving end of the hopper, the evacuation of such receiving end first is highly desirable in order to provide space for the inflowing disintegrated material.

Mounted externally on the lower rearward portion of vehicle 10 is a movable bumper 119 that is actuated by a shuttle car as it reaches loading position to energize a suitable electrical switch (not shown) for the purpose of initiating the operation of delivery conveyor 62 and to terminate such operation as the loaded shuttle car backs away. As such arrangements are well known in the art, no detailed illustration or amplification is believed necessary.

In operation, the vehicle 10 is adapted to move along and behind a continuous miner and to receive the disintegrated material which the latter discharges. As the vehicle steadily receives material in its material receiving end from the discharge section of a miner, the pile of material rises up under and into the flights of the continuously slowly rotating conveyor flights or scrolls. The top of the pile is levelled and conveyed back in the car by the action of the scrolls to the first interruption in flights. At this point the pile grows in all directions to an extent determined by the angle of respose of the material. Just about the time that the material heaps nearly to spill over the hopper sides it also reaches the next screw flight which starts to erode the pile and serves as a stopping device to the heaping action. Again this screw flight conveys to the next interruption where the heaping action is repeated. If the operating cycle is properly timed, a shuttle car should appear and load out before the hopper is completely full.

When a shuttle car appears, it engages the bumper 119, thus initiating operation of the flight discharge or delivery conveyor 62. By appropriately controlling the speed of variable speed motors 76, delivery conveyor 62 may be driven at such a relative rate as will effect, ordinarily in a fraction of a minute, the complete delivery of the initially stored load from hopper 20. It should be noted, however, that during the rapid discharge of the hopper, disintegrated material is constantly being received in the material receiving end of the hopper at the normal rate of delivery by the miner and that such end is evacuated first to enable material to be received therein. After the shuttle car is loaded, it is backed away terminating the operation of flight discharge or delivery conveyor 62. Accordingly, it will be readily apparent that the apparatus of this invention is adapted to accommodate the relatively continuous discharge of a "continuous miner" during the intervals when the shuttle cars are "changing out."

Fig. 5 shows another embodiment of the material receiving, storing, and discharging apparatus of this invention which is very similar to the above described embodiment with the exception that the longitudinal axes of the conveyor scrolls or screw flights 90′ and 92′ are not coplanar in a horizontal plane, but rather coplanar in a plane that is inclined upwardly rearwardly from the forward end of hopper 20′. All of the other structural features and their resultant functions including the discharge or delivery arrangement of the first embodiment are duplicated in the embodiment of Figure 5 and the same numbers primed are used to identify elements which are similar to those used in the first embodiment.

This second embodiment has an advantage over the embodiment first described in that the material has progressively more clearance as it is conveyed rearwardly by the scrolls due to the progressive increase in vertical height from the bottom of the hopper to the conveyor screws or scrolls. This becomes significant, and particularly in low height mineral veins, when it is realized that the material receiving end of the hopper must necessarily be vertically shortened to accommodate the discharge section of the miner.

A third embodiment of the material receiving, storing and discharging apparatus of this invention is shown in Figure 6 and is similar in every respect to the first embodiment with the exception of the orientation of the screw conveyors and further in employing three screw conveyors rather than two. The same numbers double primed are used to indicate parts similar to those employed in the first embodiment.

Extending transversely across hopper 20″ are three screw conveyors generally designated as 120, 122 and 124 longitudinally spaced along the length of hopper 20″ and having their axes, respectively, lying in a common horizontal plane parallel to the hopper bottom. The screw conveyors may have a suitable common drive unit to rotate such conveyors in the same direction or alternately, they may be driven by suitable individual drive units that are synchronized in a timed relationship. As the general construction of the screw conveyors is quite similar, with the exception of having their intermittent flights spaced differently, the construction of conveyor 120 alone will be described in detail.

Conveyor 120 comprises an elongated

shaft 126 extending transversely across the width of hopper 20" and having its ends suitably journaled in bearings (not shown) as is well known in the art. Shaft 126 is disposed downwardly adjacent the top surface of hopper 20" and lies parallel to the hopper bottom. Slidably and telescopically received on shaft 126 are a plurality of spaced tubular members 128 of varying lengths having spiral screw conveyor flights or scrolls 130 rigidly secured thereon respectively as by welding. A plurality of threaded apertures 132 are spaced along the longitudinal length of shaft 126 so that the tubular members 128 can be secured in a variety of suitable positions along the length of shaft 126 as by screws 134 for example. It is to be appreciated that the principles of this invention contemplate the use of any other means for suitably positioning the tubular members 128 longitudinally along the shafts 126.

In operation, as material is discharged into the receiving end of hopper 20", the pile of material rises upward and into the flights of the slowly rotating screws. When bulk material comes into contact with a rotating, unconfined helicoid such as found in the flight of a screw conveyor, it is repulsed from the center of rotation at an angle to the axis of rotation. The angle of repulsion is determined by the angle of the helicoid, commonly defined as pitch. By way of example, in a flight of 1:1 pitch, the angle of repulsion would be 45°. Accordingly, and as illustrated in the embodiment of Figure 6, flight action of screw conveyor 120 would convey the material in the direction of the arrows to a centrally located point X. Here the bulk material would heap until the angle of repose for the material would effect contact of such material with the flights of conveyor 122. Just as the material heaps nearly to spill over the hopper sides, it also reaches the flights of conveyor 122, which are effective to erode the pile by serving as an obstruction to the heaping action and by further conveying the material to the next conveyor 124 where the heaping action is repeated. The spacing of the conveyors longitudinally of hopper 20" and the spacing of the flights on the conveyor shafts would be determined by the composition of material, size and angle of repose for the material handled. Discharge of material from the hopper 20" is effected by the same structure and in the same manner as in the first embodiment.

A fourth embodiment of the material receiving, storing and discharging apparatus of this invention is shown in Figures 7 and 8 and comprises a vehicle generally designated as 150 having a body 152 supported by a suitable pair of propelling wheels 154 and a suitable pair of swivelly mounted steerable wheels 156 similarly constructed to the propelling and steerable wheels of the first embodiment and operative in the same manner. The hopper differs from that of the first embodiment described by having a wider material receiving and storing compartment or hopper 158 and by providing an endles flight discharge or delivery conveyor 162 that extends from a rearward point in the bottom of the hopper upwardly and rearwardly along the frame of the discharge section rather than along the length of the hopper. The delivery conveyor is driven by suitable variable speed motors 164 in a manner similar to that described in connection with the first embodiment.

Hopper 158 comprises a deck or floor having a frusto-conical shape indicated at 166 extending from a base portion 168 and terminating at its minimum diameter in a substantially vertically extending boss portion 170. Hopper 158 also comprises side walls 172 and 174 which diverge upwardly outwardly from base portion 168 and terminate in upper edges 176 and 178 respectively. The rear end portion of walls 172 and 174 define a passageway 180 for accommodating the discharge conveyor 162. A forward end wall 182 slopes upwardly and outwardly from base portion 168 and terminates in an upper edge 184.

Means, generally designated 186, are provided to slowly distribute the material received in the hopper, such means comprising a hub 188 rotatably mounted about boss portion 170 and coaxial therewith and having a plurality of elongated arms or paddle blades 190 extending radially outwardly and slightly downwardly from said hub portion so that the bottom edges 192 thereof are disposed adjacent and parallel to the frusto-conical surface of the hopper deck in a substantially mating relationship therewith. Although the opposed surfaces of the hopper deck and blade edges are preferably inclined downwardly, it is to be appreciated that horizontal or any inclination of such surfaces are envisaged without departing from the present invention. Suitable drive means (not shown) are preferably located in the boss portion 170 and operatively connected to hub 188 for the purpose of rotating the hub and blade assembly about a vertical axis. With reference to Figure 8, it will be seen that the pushing or material engaging faces 194 of blades 190 are disposed in a vertical relationship.

In operation, the vehicle is adapted to move along with and behind a continuous miner and to receive the disintegrated material which the latter discharges. Such material is evenly distributed throughout the hopper by rotation of the blades, and.

if the operating cycle is properly timed, a shuttle car should appear before the hopper is completely full. Engagement of a shuttle car with the bumper initiates rapid operation of the delivery conveyor in the same manner as previously explained in connection with the first embodiment. When the shuttle car is loaded, it is backed away and disengaged from the bumper, thus terminating the operation of the delivery conveyor.

This embodiment has the advantage of employing a unitary structure for distributing material which is compact and simple in construction requiring a minimum number of parts, reliable in operation and easy to manufacture.

Figure 9 illustrates another modification of the distributing means of the structure shown in Figures 7 and 8, which comprises a plurality of elongated arms or paddle push blades 196 extending outwardly and downwardly from hub 198, said blades having faces 20 which are inclined upwardly obliquely from their bottom edges 202 to their upper edges 204. Upon rotation of the blade assembly in a counterclockwise direction or in the direction indicated by the arrow A in Figure 9, blade faces 200 will effect a force component angled upwardly as shown by the arrow B and will not only distribute the material to the far reaches of the hopper but will also crowd the material in the space directly above the blade assembly so as to maintain the material in the hopper at the same level.

Figure 10 illustrates still another modification of the distributing means of the structure shown in Figures 7 and 8, which comprises a plurality of curved arms or paddle blades 210 extending outwardly from hub 212, said blades having inclined curved faces 214. It should be noted that the portion of the blades remote from the hub are curved toward the direction of rotation. Upon rotation of the blade assembly in a counterclockwise direction or in the direction indicated by the arrow C in Figure 10, blade faces 214 will effect a force component inwardly and upwardly as shown by the arrow D to crowd the material inwardly as well as upwardly and cause the load to heap in the central portion of the hopper.

The operation of the embodiments of Figures 9 and 10 are similar to that of Figure 7, excepting that the material will be maintained at the same level in the central portion of the hopper by means of the modification of Figure 10.

Regardless of arm or blade configuration, a low vertical profile for the blade is desirable to restrain the material from revolving in the hopper as much as possible. The arms slide under the load creating a shear plane above such arms and thereby effect an intermittent lifting action.

A further embodiment of the material receiving, storing and discharging apparatus of this invention is shown in Figure 11 and comprises a vehicle 250 which is very similar to the first embodiment described with the exception that a drag conveyor 252 is utilized in lieu of pair of conveyor scrolls. Such drag conveyor comprises an elongated, endless chain, flight conveyor horizontally disposed and located upwardly adjacent the top surfaces of the hopper. The endless flight conveyor comprises a pair of side chains 256 (only one of which is shown in Figure 11) located inwardly adjacent each side of the hopper and which pass around sprockets 258 arranged on transversely extending shafts 260 at the opposite ends of the conveyor, such shafts being suitably journaled at their opposite ends in the side walls of the hopper and driven by any conventional means in a manner well known in the art. Secured intermediate of these side chains are a plurality of transverse flights or scraper bars 262 which travel in an orbital path opposite to the direction of movement of the bottom delivery conveyor as hereinbefore explained in connection with the first embodiment.

In operation, as material is being deposited in the material receiving end of the hopper from the discharge section of a miner, the pile of material rises and grows in all directions to an extent determined by the angle of repose of the material. Just about the time that the material heaps to spill over the forward end, it also reaches the drag conveyor which erodes the pile at the forward end of the hopper and distributes it rearwardly. Discharging of the hopper into a shuttle car is effected by a bottom endless delivery conveyor and its operation and termination is effected by the engagement and disengagement respectively of the shuttle car with the hopper bumper. This embodiment has the advantage of effectively distributing material by leveling the advantage of effectively distributing material by leveling the top of such material over a larger area.

Still a further embodiment of the material receiving, storing and discharging apparatus of this invention is shown in Figures 12 and 13 and comprises a vehicle 270 having only a single conveyor for distributing material therein and discharging the same. The hopper of this vehicle has a partition 272 extending longitudinally from a forward point inwardly adjacent the forward end of the hopper to a rearward point inwardly adjacent the rearward end of the hopper and extending vertically upwardly from the hopper bottom to adjacent the top of the hopper. A slot 274 is provided peripherally around the base of the partition adjacent

the hopper bottom to receive an endless universal chain conveyor driven by sprockets 278 mounted on vertically disposed shafts 280 at the opposite ends of the conveyor chain, such shafts being suitably journaled at their lower ends in the hopper bottom and driven by any conventional means in a manner well known in the art. Secured to the endless chain is a plurality of laterally outwardly extending flights or scraper bars 282 which can travel in either a clockwise or counterclockwise direction along the hopper bottom. Pivotally mounted to the rear portion of the hopper are a pair of plate members 284 and 286 which form continuations of the hopper bottom, side walls and rear wall and which are normally held in an abutting relationship so as to constitute a portion of the hopper sides and bottom for enclosing material therein. These plate members are adapted to be pivotally actuated outwardly with respect to each other to expose the rear portion of the conveyor for allowing the discharge of material thereby into a shuttle car. Actuation of such plate members outwardly and inwardly with respect to each other is effected by engagement and disengagement respectively of the shuttle car with the hopper bumper.

In operation, as material is being deposited in the material receiving area of the hopper and is being heaped to nearly spill, the conveyor is intermittently actuated to displace the material from such area in order to make space for the continuously incoming, disintegrated material This cycle is repeated to intermittently evacuate material from the material receiving end. When a shuttle car appears and effects an outward pivoting movement of the plate members, the material located at the rearward portion of the hopper will be discharged by gravity into the shuttle car and the remainder of the material will be conveyed to this discharge point by rapid continuous operation of the endless chain conveyor. This embodiment has the advantage of utilizing only a single conveyor for performing two functions; specifically, distributing material throughout the hopper and discharging such material from the hopper.

If desired, a swingable tail may be provided adjacent the rear of the apparatus of the various embodiments disclosed, such swingable tail being pivotally mounted about a vertical axis and being adapted to convey material into a shuttle car which is disposed at an angle with respect to the longitudinal axis of the material receiving, storing and discharging apparatus of the present invention. Also, the tail portion may be raised and lowered, and as such arrangements are well known in the art, no detailed amplification is believed necessary.

It will be evident that this invention is well adapted to handle the relatively continuous discharge of "continuous miners," that it readily avoids the dropping of material on the mine bottom during the intervals between the times when the material transport devices to which it is adapted to discharge are in material-receiving position at its discharge end, that it is capable of changes in operation to meet different loading and discharge cycles.

Preferred embodiments of the principles of this invention having been hereinabove described and illustrated, it is to be realized that variations in design may be applied without departing from the broad scope of this invention.

WHAT WE CLAIM IS:—

1. A mobile apparatus for intermittently discharging material, said apparatus comprising a hopper section having a discharge opening opposite a forward receiving end and a capacity of storing material continuously received, material displacing means for distributing the received material throughout the substantial confines of the hopper and between the receiving end and the discharge opening, a discharge section extending from the discharge opening and having a discharge end, and conveyor means extending from the bottom of the hopper section to the discharge end and arranged for moving material rearwardly and outwardly of the hopper, means being provided for the operation of the conveyor means to discharge material.

2. Apparatus according to claim 1 in which the hopper section is an elongated compartment, the conveyor means extends along the length of the bottom of the hopper section and the material displacing means comprises rotatable means located at the top of the hopper section and adapted to move material piling up at the receiving end toward the discharge opening.

3. Apparatus according to claim 2 in which the rotatable displacing means comprises a plurality of scrolls arranged in locations where said scrolls erode and level piles of material.

4. Apparatus according to claim 3 in which the plurality of scrolls are mounted on a pair of rotating shafts extending longitudinally of the compartment along the longitudinal side walls of the compartment.

5. Apparatus according to claim 4 in which the shafts are disposed in a plane inclined upwardly rearwardly from the receiving end of the hopper section.

6. Apparatus according to claim 3 in which the plurality of scrolls are mounted on a plurality of rotating shafts extending transversely of the elongated compartment.

7. Apparatus according to claim 2 in

which the rotatable displacing means comprises a drag conveyor extending longitudinally of the compartment.

8. Apparatus according to claim 2 in which restrictor plates are mounted in the bottom portion of the hopper section above the conveyor means in a position where material forwardly of said plates will travel with the conveyor means underneath said plates and material heaped above and rearwardly therefrom will be restrained.

9. Apparatus according to claim 1 in which the hopper section comprises a floor of frusto-conical shape and side walls diverging upwardly and outwardly from said floor and the material displacing means comprises rotating means cooperating with the frusto-conical shape in distributing the material gravitationally dropping from the receiving end, the conveyor means extending from underneath the edge of the floor to the discharge opening.

10. Apparatus according to claim 9 in which the rotating distributing means comprises a hub mounted for rotation about the vertical axis of the frusto-conical shape and having blades in substantially mating relationship with the frusto-conical surface.

11. Apparatus according to claim 1 in which the material displacing means and the conveyor means comprise a single conveyor extending along the length of an elongated hopper section and along the length of an elongated discharge section having a bottom wall and side walls extending from the discharge opening about the discharge end, said discharge section includes pivoted wall portions operable for movement into a position exposing the discharge end of the conveyor, and control means is provided for intermittently operating the conveyor between loading operations, the operating means for discharge operation of the conveyor being associated with means for operating said wall portions.

12. Apparatus according to claim 11 in which the single conveyor comprises an endless chain provided with laterally and outwardly extending bars, the chain being arranged for movement of said bars along the bottom of the hopper and discharge sections about an upstanding partition.

13. Apparatus according to any one of the preceding claims comprising a vehicle and power means for movement of the mining machine.

14. An apparatus for discharging material substantially as hereinbefore described with reference to and as shown in Figure 1, 4, 5, 6, 7, 11 or 12 in the accompanying drawings.

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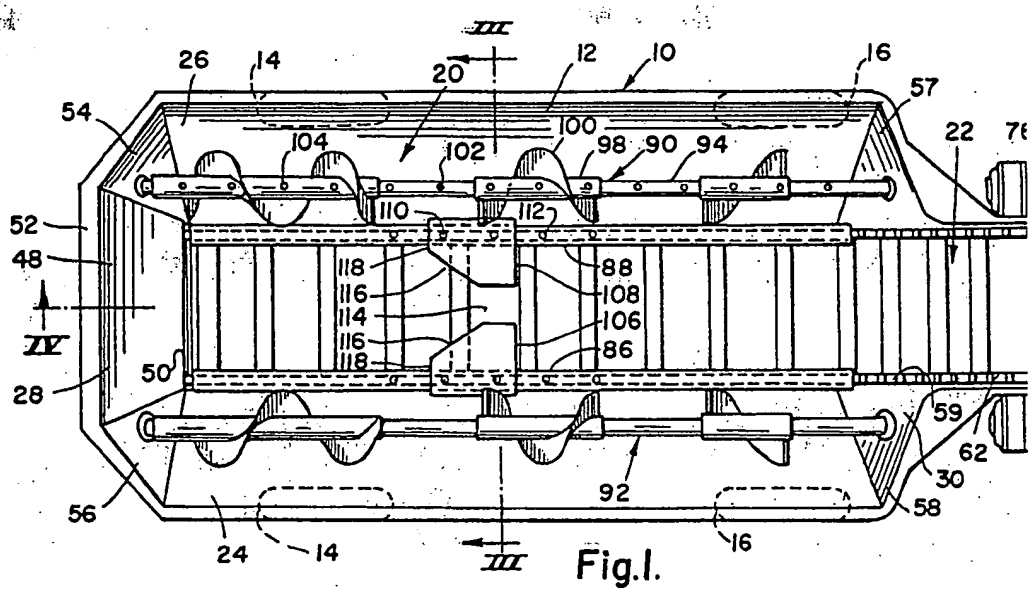
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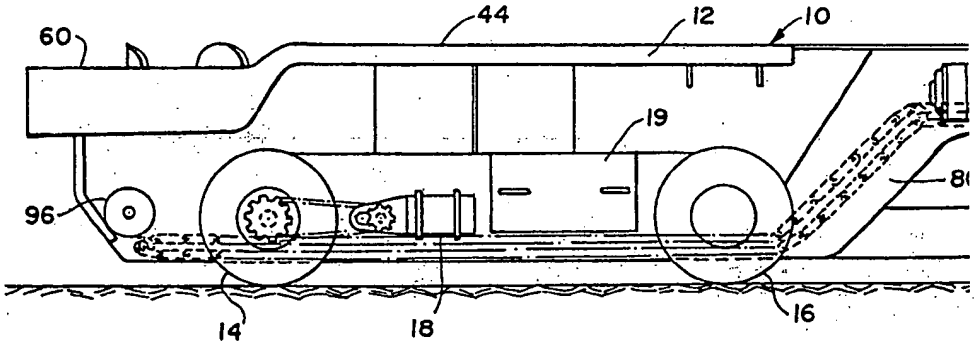
Fig.1.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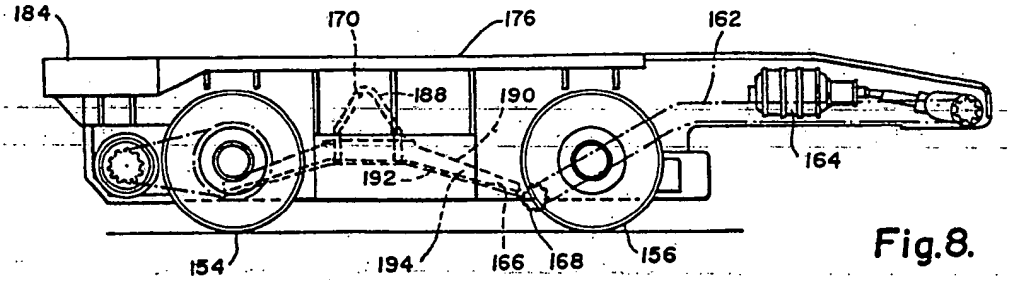
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Fig.8.

1,070,826 COMPLETE SPECIFICATION
3 SHEETS

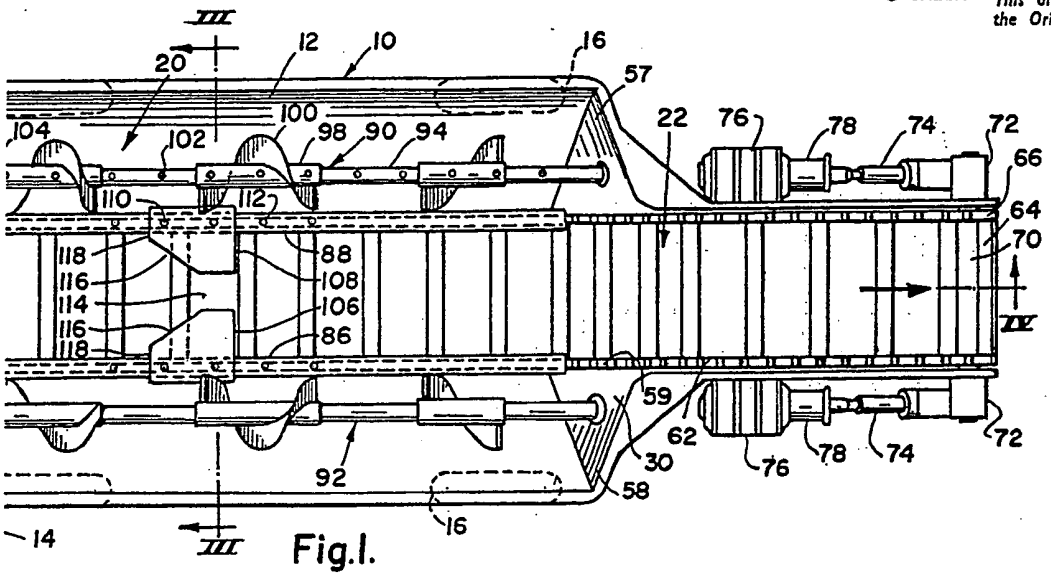
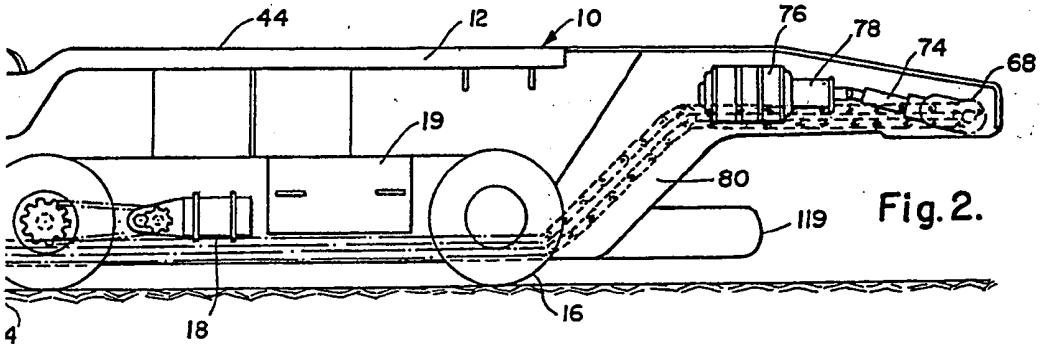


Fig.1.



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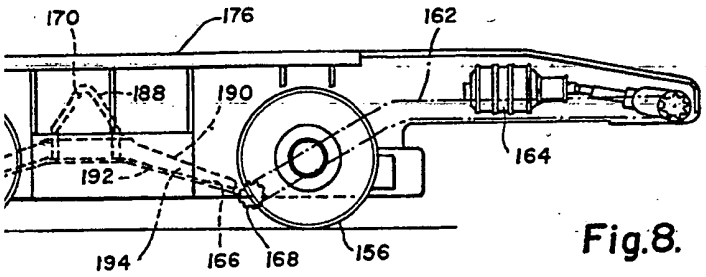

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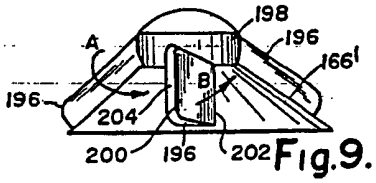


Fig.9.

1,070,826 COMPLETE SPECIFICATION
3 SHEETS

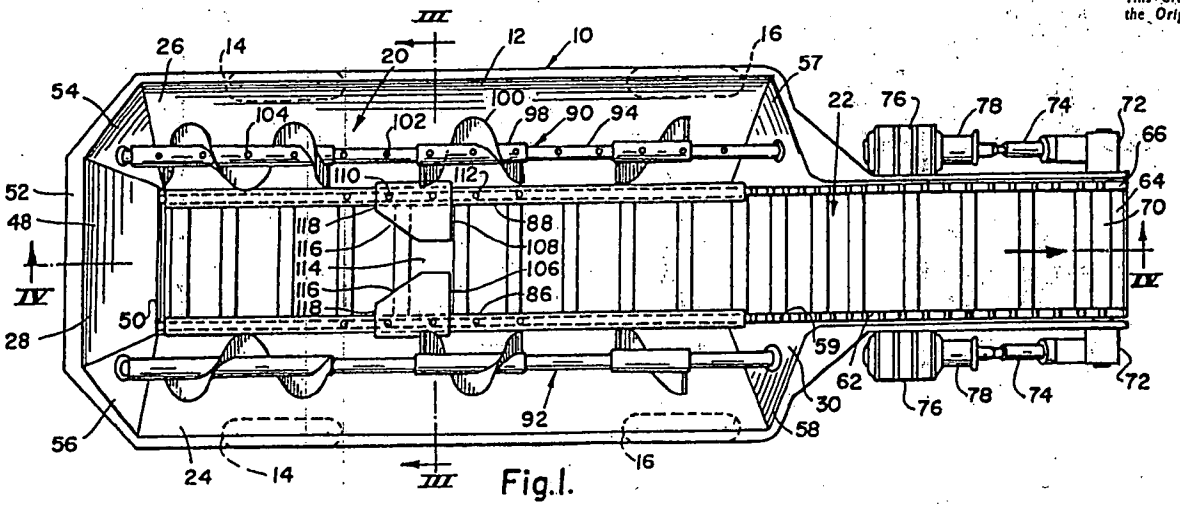
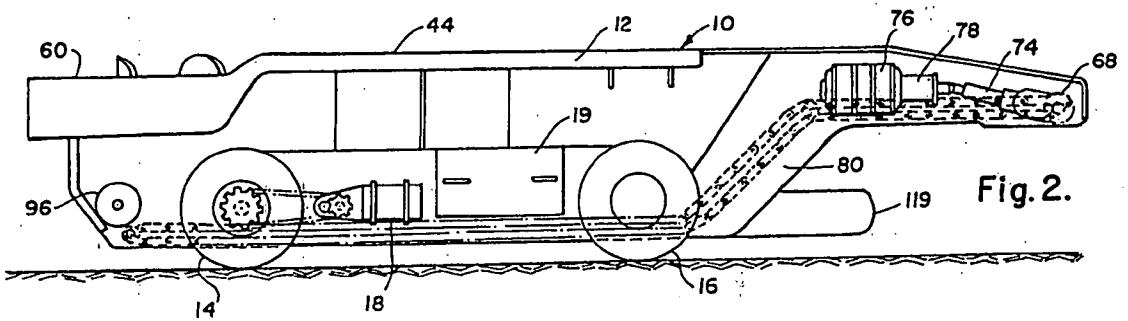


Fig.1.



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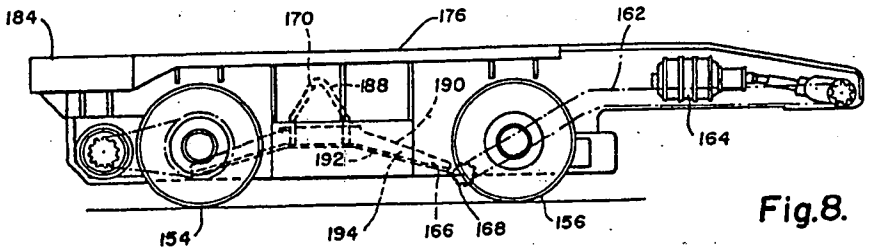

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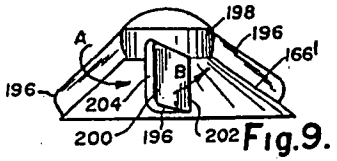

Fig.9.

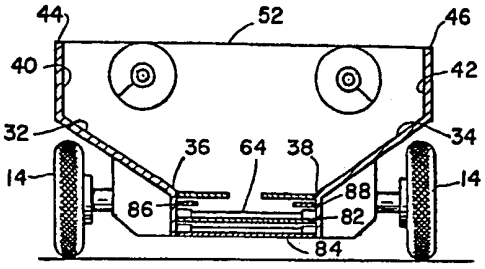

Fig.3.

Fig.

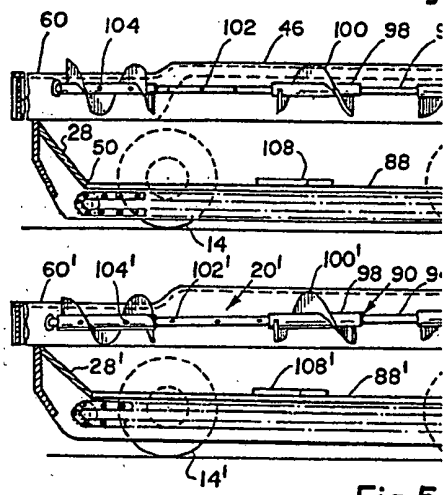

Fig.5.

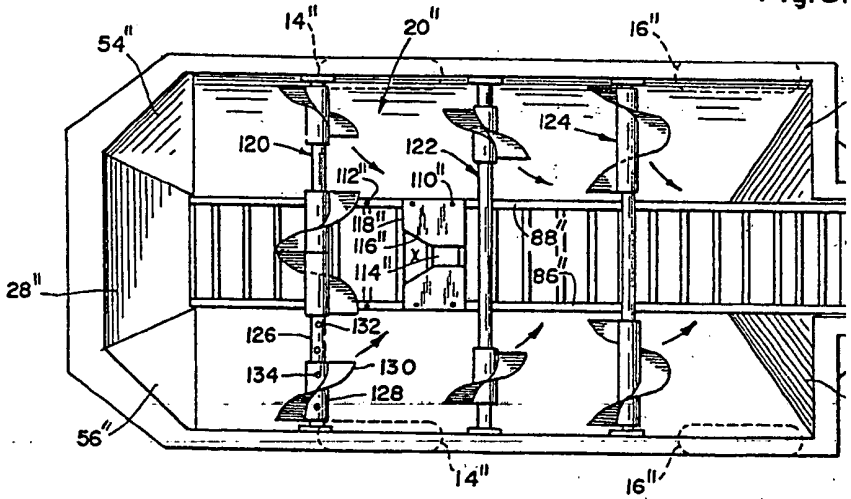

Fig.6.

1,070,826 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

Fig.4.

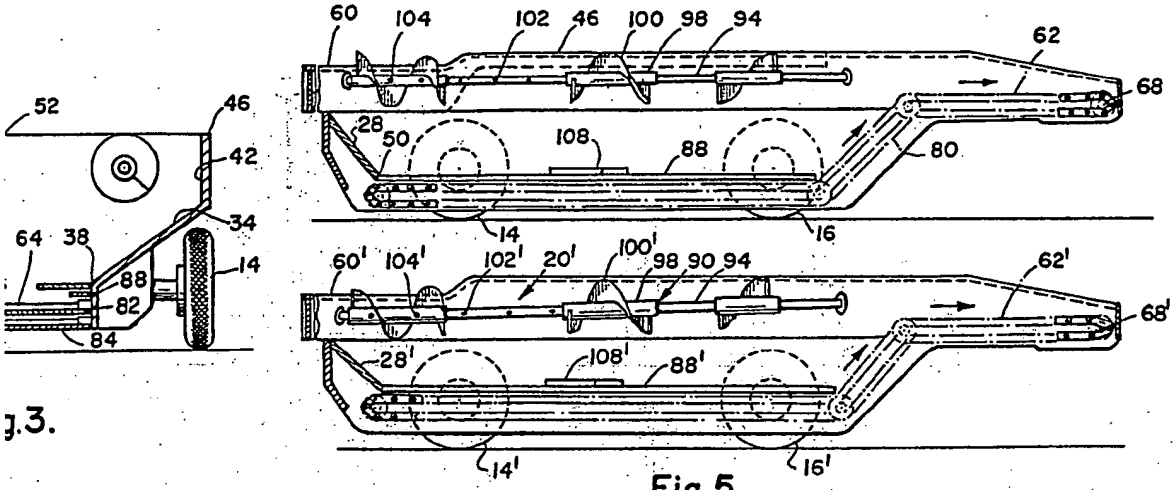

Fig.3.

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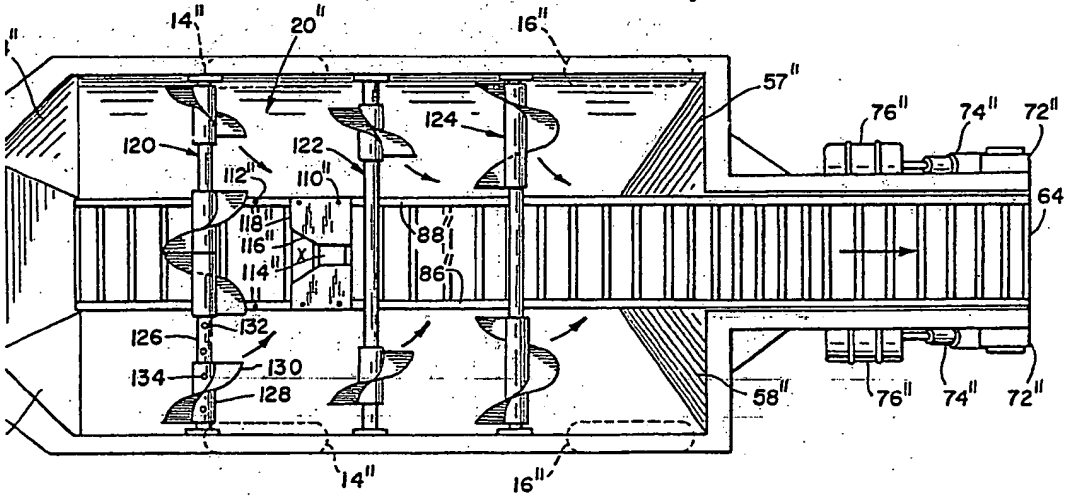

Fig.6.

1,070,826 COMPLETE SPECIFICATION
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SHEET 2

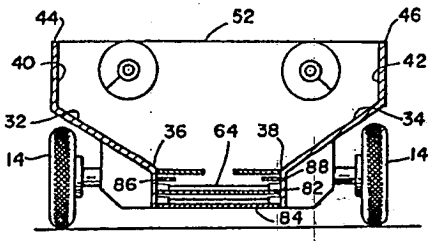


Fig.3.

Fig.4.

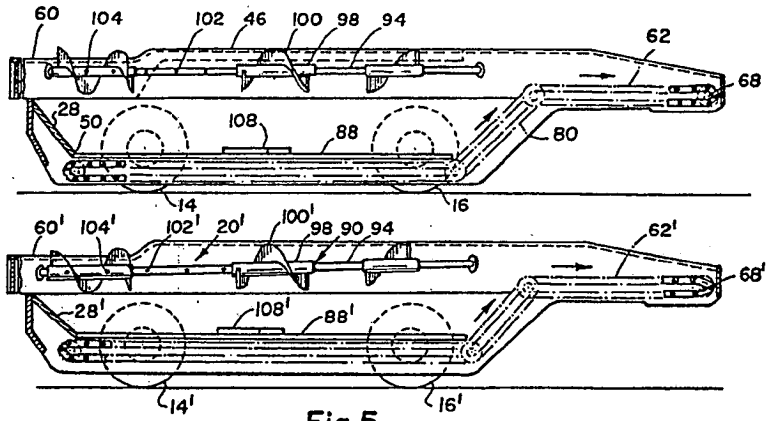


Fig.5.

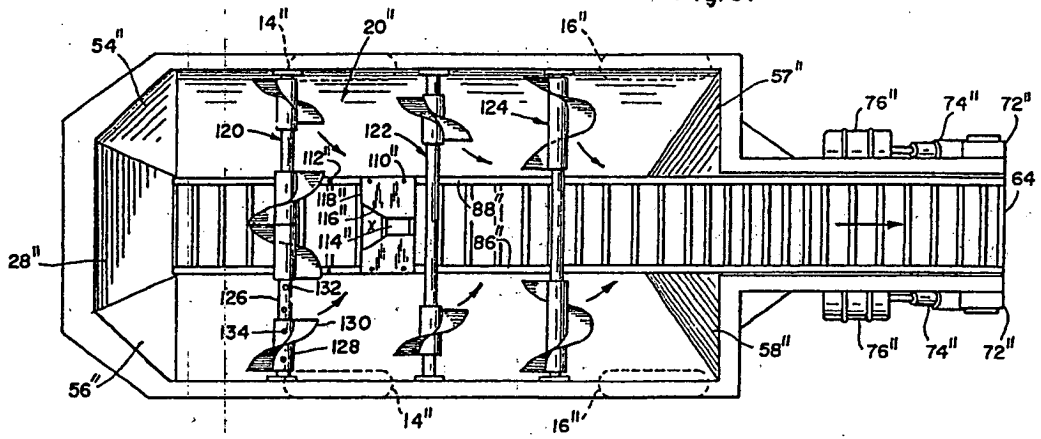
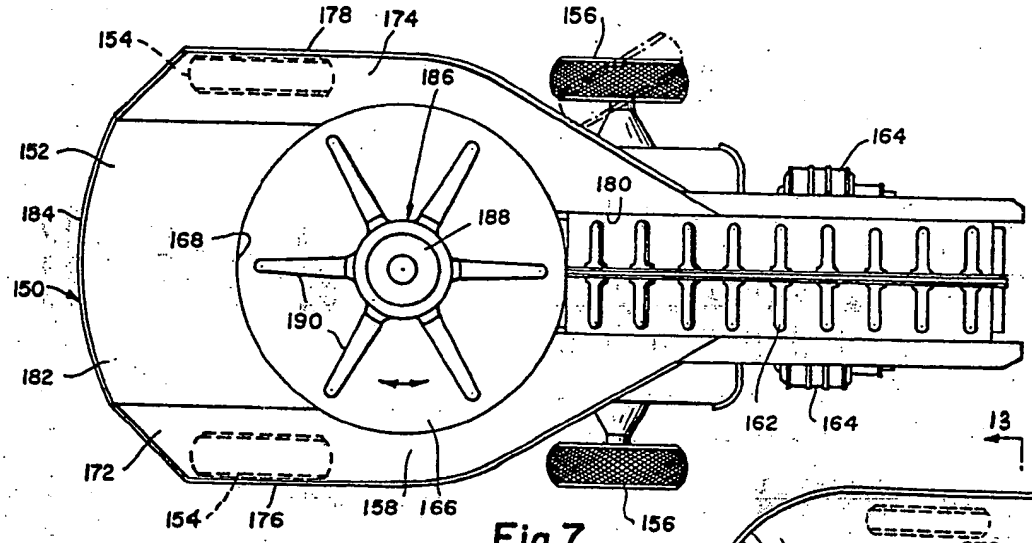


Fig.6.



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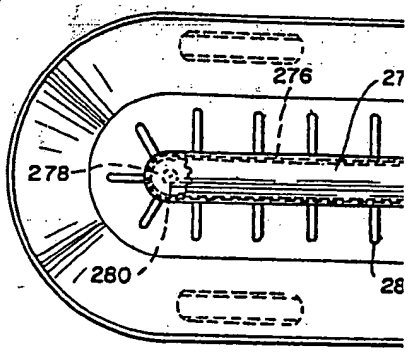

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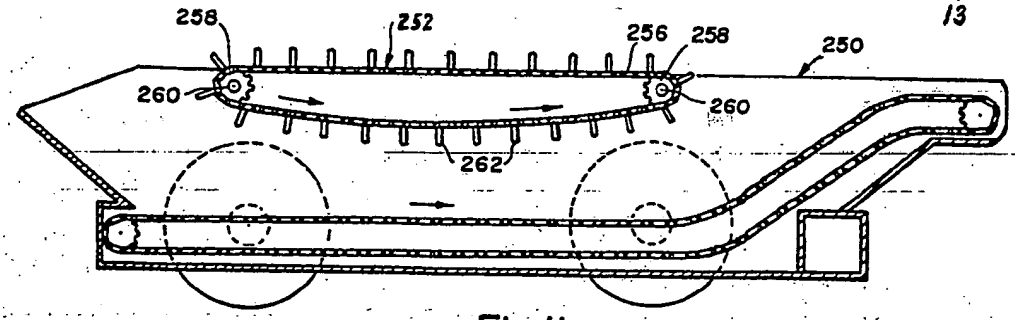


Fig.11.

1,070,826 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 3

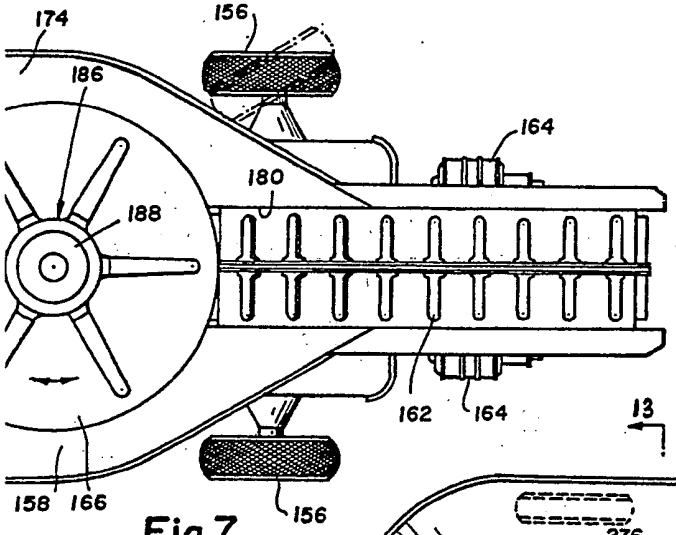
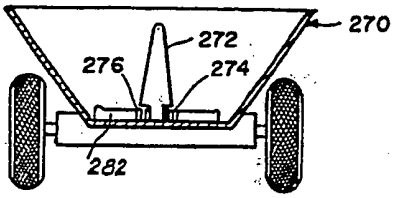


Fig.7.



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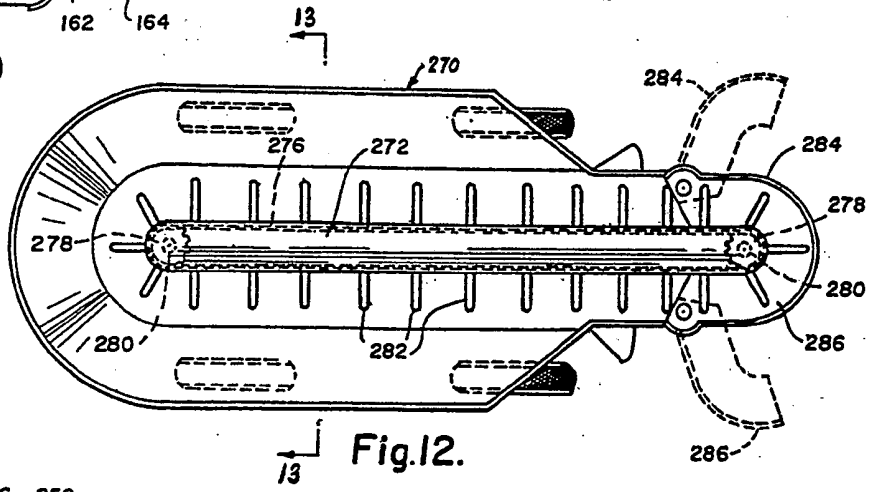

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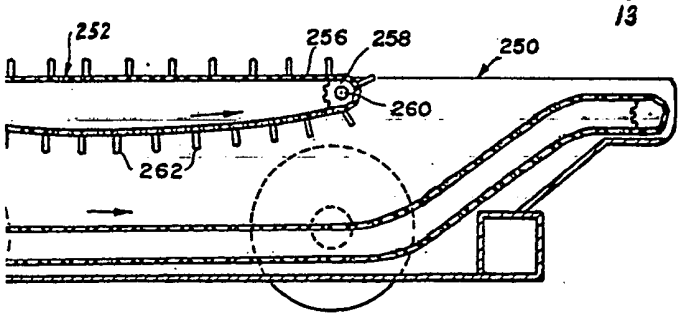

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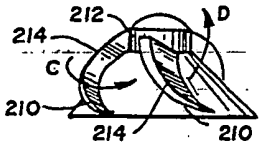
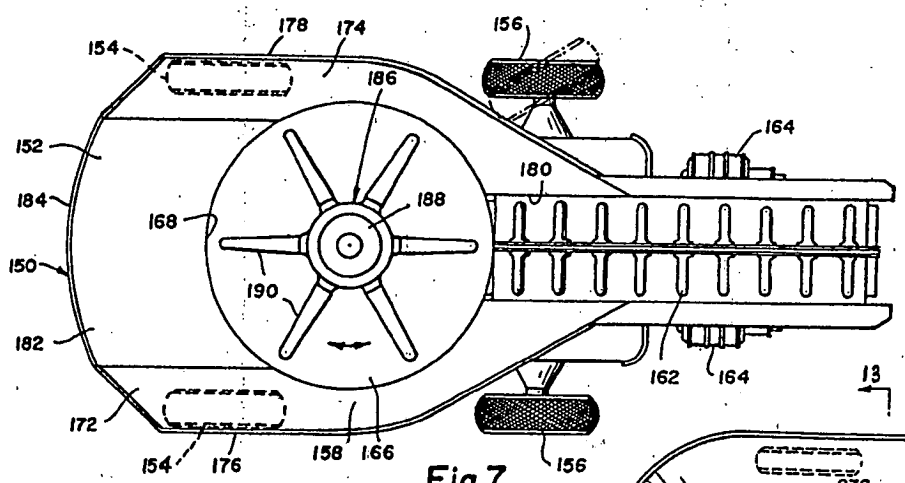


Fig.10.

1,070,826 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 3



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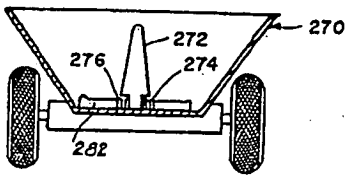

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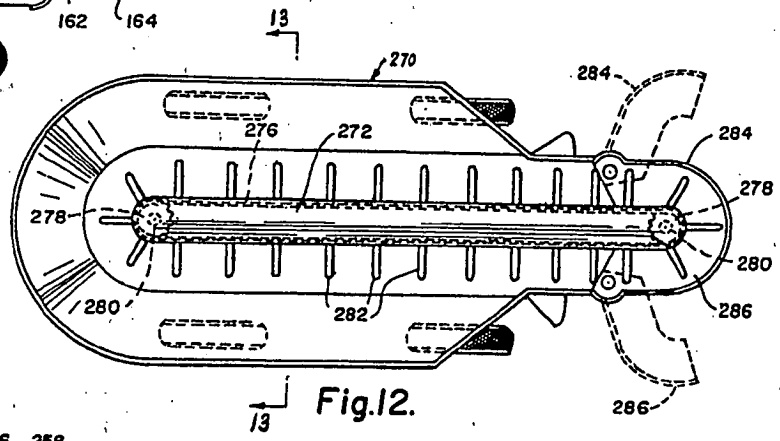

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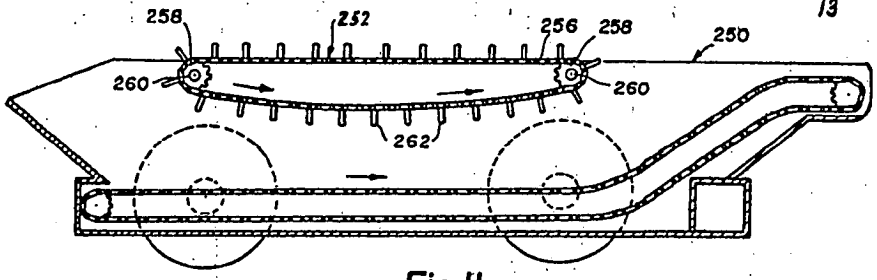

Fig. 11.

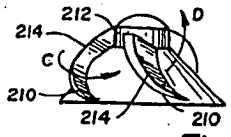

Fig. 10.